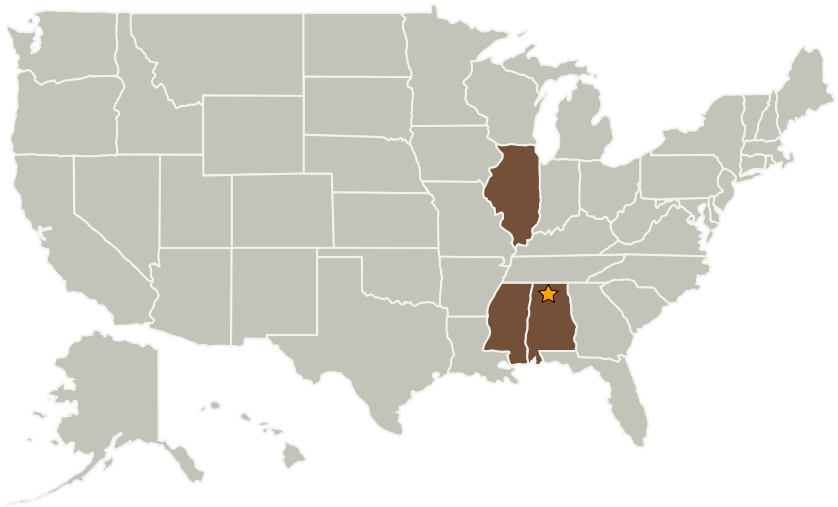
Two Phase Flow Tools for Solid Motors with Dynamic Burning Surface Recession, Phase I

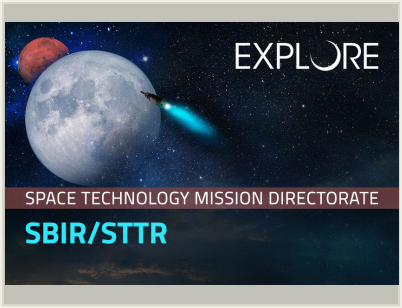
Completed Technology Project (2009 - 2010)

Project Introduction

The challenges of designing, developing, and fielding advanced propulsion systems continue to increase as NASA's Vision for Space Exploration Program moves forward with new solid propulsion elements ({i.e., Ares I and V). Our existing computational tool for solid motor analysis (BurnSurf) generates modest surface recession, but the mesh deformation techniques employed often fail as the surface regression increases, particularly near corners. For complex grain designs with highly complicated surface topologies (e.g., star shapes), simple mesh deformation is no longer desirable. Our proposed innovation will utilize surface mesh modification and volume mesh generation to locally rebuild the burning surface mesh and the adjacent volume mesh. The innovation will address integrated surface and volume mesh regeneration and reconnection techniques for modifying mesh topologies along with two phase burning surface models to create a unique 3D software tool for next generation solid motor internal environment characterization. Our research products will provide NASA with the important capability to simultaneously analyze solid propellant combustion, heat transfer, and grain burnback within a single framework. We will demonstrate feasibility of the approach using a two phase grain burning model coupled with surface recession for a simple shape in the TRL range of 3-4.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Tetra Research Corporation	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Princeton, Illinois

Primary U.S. Work Locations	
Alabama	Illinois
Mississippi	

Project Transitions

January 2009: Project Start

January 2010: Closed out

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Rex Chamberlain

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.4 Solids